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AUTHOR Single, Peg Boyle; Muller, Carol B.
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ABSTRACT

This paper reports on experiences conducting and evaluating MentorNet, a nationwide structured electronic mentoring (ementoring) program that pairs women engineering students, related science students, and math students with industry professionals and provides support to aid the development of year-long ementoring relationships. MentorNet's goal is to increase the representation of women in science, mathematics, engineering, and technology through the provision of mentoring relationships with industry professionals. It works with a consortium of organizations to recruit mentors and proteges, fund, and advertise. The program involves e-mail messages between mentors and proteges and electronic discussion groups for community building. In the 1998-99 program, 693 industry professionals and 963 students were recruited, and 550 pairs were matched (515 of whom completed the year-long program). After matches were finalized, MentorNet sent out regular discussion suggestions to all pairs. Throughout the year, MentorNet maintained a database for tracking interactions. After actively accepting the ementoring match, more proteges than ementors failed to follow through on their commitments by not responding to their mentors. The ementors had more technology problems than the proteges, which tended to disrupt mentoring. Students were more particular about the requirements for a suitable partner than were mentors. (Contains 18 references.) (SM)

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Electronic Mentoring:

Quantifying the Programmatic Effort

Peg Boyle Single and Carol B. Muller

MentorNet

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Author Note

Dr. Single is the Mentoring Specialist and Dr. Muller is the Executive Director for MentorNet, the National Electronic Industrial Mentoring Network for Women in Engineering and Science. MentorNet is an ongoing program; for more information about MentorNet, visit the web site at <www.mentornet.net>. The program and this paper are supported by grants from AT&T, Cisco Systems, Intel, IBM, Ford, Hewlett Packard, The Institute of Electrical and Electronics Engineers (IEEE), Microsoft, The International Society for Optical Engineering (SPIE), Los Alamos National Laboratory, Texaco, SAP Labs, the U.S. Department of Education's Fund for the Improvement of Postsecondary Education, and in-kind support from the College of Engineering at San José State University

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Correspondence concerning this paper should be addressed to Peg Boyle Single, MentorNet c/o College of Engineering, San José State University, San José, CA 95192-0080. Electronic mail may be sent via Internet to pboyle@email.sjsu.edu.

Introduction

Electronic communications (ECs) have taken the academy by storm. While once limited to the communications of elite scientists, ECs, such as personal electronic mail (email) and connections to the World Wide Web, are now ubiquitous on college campuses. Electronic discourse between faculty and students is increasingly common, almost a third of all college courses use email (Guernsey, 1997). Instructors are using ECs to conference with students during classtime (Sirc and Reynolds, 1990), and outside of classtime (Bump, 1990). Co-curricular programs are using email to connect students with staff (Kinkead, 1987).

A relatively new use for ECs that is gaining much momentum and interest is electronic mentoring (ementoring). Ementoring is mentoring that is conducted using ECs, particularly email, as the primary means of communication. ECs provide a flexible communication environment independent of time and space, allow for asynchronous exchanges, and provide attenuation of status differences that may facilitate the development of relationships (Sproull and Kiesler, 1992; Steinberg, 1992). Ementoring extends mentoring opportunities to many more students and allows mentors otherwise constrained by time and geography to participate (Muller and Single, 1999), thus alleviating a major obstacle to the development of mentoring relationships (Boyle and Boice, 1998b; Noe, 1988).

These advantages and the ease with which ementoring programs can be developed may mask the administrative resources and staff required to make the programs effective (Education Development Center, 1998; Single and Muller, 1999). Because of the physical distance between program developers and participants, the temptation is great to match mentors with protégés but then provide little in the way of coaching, training, and follow-up. In addition, using ECs as a

delivery system for mentoring not only overcomes time and space constraints, but also allows for economies of scale and potential growth unprecedented when conducting face-to-face mentoring programs. Therefore, it could be possible to attain rates of growth not possible with face-to-face mentoring programs.

While ementoring is a relatively new phenomenon, we can learn from the mistakes of the face-to-face mentoring movement, where too many early mentoring programs were established with good intent and expectation, but failed to attain their promise or results (Freedman, 1992). Research and practice on *face-to-face* mentoring programs have suggested that programmatic supports, as indicated by structured or facilitated mentoring programs, maximize the benefits associated with participation in the mentoring programs (Boyle and Boice, 1998b; Murray, 1991). *Structured* mentoring and ementoring programs not only match mentors with protégés, but also provide training, coaching, and assessment to facilitate the development of effective mentoring relationships and to improve future program renditions, often requiring the attention of a mentoring specialist or program coordinator (Single and Muller, 1999; Wunsch, 1994).

This paper reports on our experiences conducing and evaluating MentorNet. In particular, this paper reports on the efforts required to match and maintain pairs throughout the yearlong ementoring process. MentorNet <www.mentornet.net>, the National Electronic Industrial Mentoring Network for Women in Engineering and Science, is a nation-wide structured ementoring program. MentorNet pairs women engineering, related science, and math students with industry professionals and provides support to aid the development of yearlong ementoring relationships. MentorNet's growth plan has been ambitious, and has been more than realized for its to-date programs. In 1998-99, MentorNet exceeded its goal of pairing 500 women students with mentors when it paired 515 students from 26 colleges and universities with professionals, serving as

electronic mentors (ementors), from 261 different companies, government labs, and governmental agencies. In the current program, MentorNet paired 1250 students from 36 colleges and universities with professionals at 588 different companies, government labs, and governmental agencies. See Table 1 for MentorNet's growth plan.

The program goal is to increase the representation of women in the science, mathematics, engineering, and technology (SMET) fields through the provision of mentoring relationships with professionals in industry. Mentoring is a well-accepted strategy for supporting and increasing the representation of women in fields where they remain underrepresented (AWIS, 1993; 1995; Muller and Pavone, 1997) and helps integrate newcomers into a field (Boyle and Boice, 1998a).

MentorNet works with a consortium of organizations to recruit mentors, recruit protégés, fund, and advertise the program. MentorNet has gained economies of scale by offering on-line applications that transfer the information directly to a database. By doing so, MentorNet can leverage the any-time, any-place benefits of the Internet. Additionally, the initial matching process is automated, using an internally developed computer program. The protocol for the computer program is based on research and evaluation of participant outcomes; nonetheless, staff members reviewed all matches before the ementoring pairs were launched. The training portions likewise leverage technology, as we have mentor and protégé manuals on our website and are developing a group of interactive, web-based training modules for both the mentors and the protégés. The coaching aspect of the program utilizes email messages to keep in regular contact with the participants. In addition, we have set up electronic discussion groups for purposes of community building, thereby allowing for interactions among mentors and protégés who are participating in MentorNet (Single, Muller, Cunningham, and Single, in press).

While ementoring is still a relatively new phenomenon, theoretical models and best practices to guide the implementation of structured ementoring programs are still being developed (Education Development Center, 1998; Single and Muller, 1999). In kind, the literature is lacking on research that examines the *process* of implementing the ementoring program and quantifies the effort required to conduct an ementoring program. This current research begins to quantify the steps and effort required to conduct a structured ementoring program from the point that potential ementoring pairs are matched and launched until the ementoring pairs are coached to help them bring closure to the ementoring relationship.

Methods

Participants

For the 1998-99 program, we recruited 693 industry professionals who volunteered to serve as mentors. These professionals were recruited through the efforts of our corporate sponsors, who recruit internally for MentorNet, professional societies who sent recruiting email messages to their membership, professionals who had participated in MentorNet the year before, exhibits at professional conferences, word of mouth, articles and publications about MentorNet. For the same year, we recruited 963 students who wanted to be matched with an ementor. These students were primarily recruited through the efforts of the campus representatives, located at each of MentorNet's participating campuses. The campus representatives forwarded information about MentorNet directly and indirectly to students. The students heard about MentorNet from their faculty members, the Women in Engineering or Women in Science programs on campus, professional societies on campus, such as the Society for Women Engineers, school newsletters and publications, and from students who had participated in the previous MentorNet program.

Procedure

After the point that prospective mentors (professionals) and prospective protégés (students) apply with MentorNet, through the point that they are coached through closure, various steps occur. The program is conducted according to an academic calendar year, so the matching occurs at the beginning of the fall semester. The steps we examine here are for the *Matching Process* and regarding the *Participant Responses to Coaching.*

Matching process. This step covers the activities that occur between the point where professionals and students sign up to serve as mentors and protégés, respectively, through the point where they are advised of a potential ementoring match.

We posted the mentor application to our web site on July 15, 1999 and on August 15, 1999, we posted the protégé application; the applications were open through mid-October. A total of four rounds of matching were conducted, beginning on September 15 and ending mid-October. For each round of matching, we included all the professionals and students who had signed up but who had not been assigned to a final ementoring match. For each round of matching, a computerized sorting program reviewed the characteristics and the preferences of the professionals and the students and maximized the quality and quantity of the matching. Next, the MentorNet staff reviewed each match, paying close attention to the statements the students and professionals entered in open-ended fields from the application. If statements in the open-ended fields provided information that suggested an initial match was not a good match, the staff rejected the match, unmatched the pair, and placed the professional and student back into their respective pools to be matched with another ementoring partner in a subsequent round. If the match looked good, the staff marked that the match was acceptable so it would be forwarded to the next step of the matching process.

The next step of the matching process allowed the prospective mentors and protégés to review and accept or deny an ementoring match. We employed this step to ensure commitment to the program, to get increased buy-in for an ementoring match, and to weed out any who had applied but were no longer able to follow through on their commitment to participate.

As part of this step, email messages were send to the professionals giving them pertinent information about their prospective protégés, without identifying or contact information. These email messages asked the professionals to accept or deny the ementoring match. Likewise, email messages were sent to the students about their prospective mentors and asking them to accept or deny the match. If either of the potential ementoring partners rejected the match, then the pairs were unmatched and the mentors or students placed back in their respective mentor or student pools and rematched with different ementoring partners during one of the next round of matches. If applicants did not respond within the required two-week period, they were removed from participation until we had heard from them. When both ementoring partners accepted the match, then they were officially launched and email messages were sent out that exchanged contact information (names and email addresses) and that also provided suggestions for successfully starting the ementoring relationship.

During the matching process, professionals could have been matched with four different prospective protégés before they were matched, likewise, students could have been offered four different prospective mentors. Therefore, there could be more initial matches than professionals or students, since they could be matched multiple times before being provided with a final match, and there would be more initial matches than final matches. During the matching process, we kept track of the total number of initial matches, the number of matches accepted and rejected by the

MentorNet staff during their review of the matches, and the responses to the email messages asking for the applicants to review their prospective match.

Participant responses to coaching. After the matches were finalized, MentorNet sent out regular discussion suggestions to all the mentor and protégé participants. These discussion suggestions serve a coaching function for the participants. In addition, the discussion suggestions allow us to keep in contact with the participants, respond to questions, help to keep the ementoring pair viable, and allow us to intervene and rematch when an ementoring pair is not actively exchanging email messages. As a part of these messages, we solicit responses from the participants if they are not in contact with their ementoring partner, if they are uncomfortable with any of the ementoring interactions, or if they have any questions or comments.

Throughout the program year, we maintain a database in which we track all the interactions with the participants. By tracking the interactions, we can serve better the ementoring pairs by keeping records of and collecting data about the interactions between the ementoring pairs and the MentorNet staff. In addition, by tracking the interactions, it allows us to compile overall statistics on the types of the interactions that occur between the staff and the participants throughout the program year and to begin to quantify the effort required to conduct a structured ementoring program.

Results

Of the 693 professionals and the 973 students who applied, we launched 550 pairs, and 515 pairs completed the academic yearlong program. The following explains the how these pair numbers evolved from the total pool of applicants.

Matching process. Based on the automated matching algorithm, 809 pairs were made during the matching process for all four matching rounds. Keep in mind that this number exceeds the

numbers of professionals who applied since applicants could have been placed into four initial matches before a final match was accepted.

The program staff individually reviewed each of these 809 matches. Prospective ementoring pairs, which seemed inappropriate based on open-ended comments on the applications of either the professionals or the students, were unmatched and placed back in their respective professional or student pools, and rematched during the following round of matching. Of these 809 pairs, the program staff rejected 73 pairs, leaving 736 pairs.

Over the course of the four rounds (which meant that each of the mentors or students could have received a maximum of four potential matches and four email messages), each mentor and student of the 736 pairs were emailed information about their ementoring partner and given the opportunity to accept or reject the match. 80.7% of the students accepted the match compared with 88.2% of the mentors. A test for the comparison of the proportions that takes into account the paired nature of the data, the McNemar Chi Square test, indicated that the students were significantly more likely to either reject the proposed match or not respond to the email than were the mentors ($p<.001$). See Table 2 for the results of the matching process, which included the review by the MentorNet staff and by the MentorNet participants. Based on these responses, there were 550 launched pairs.

Participant responses to coaching. After the pairs were launched, they regularly (at least every other week) received a coaching message from the program facilitator. These coaching messages served as incentives for pairs to stay in contact and kept the lines of communication open between the program staff and the participants so we could intervene, as necessary. During the course of the program year, we kept track of all the interactions we had with the MentorNet participants. In many cases, the MentorNet staff was able to intervene and help an ementoring pairs

get reconnected. In a few cases, we were not. Mind you, this is not uncommon for mentoring programs to have a few pairs who do not follow through and meet as a mentoring pair throughout the program duration. Of these 550 launched mentoring pairs, by the end of the program we had 515 active pairs. During the program year, we had been notified that 40 of these pairs had ceased to exchange messages by the end of the academic-year-long program and we provided 5 rematches, totaling 515 pairs.

The reasons we heard from the participants, and often needed to take some sort of action, fell into a few categories. During the program year, we received 184 comments, questions, or concerns from the MentorNet participants. See Table 3 for a breakdown of the 184 comments. Most often, we heard from participants when they were not able to stay in contact with their ementoring partner. Of the 184 comments, 29 comments were from mentors who reported that they have not heard from the protégés, 8 comments were from students who reported that they had not heard from their mentors. Also, participants contacted us if messages to their ementoring partners bounced back; we heard from mentors 9 times notifying us that their protégés' emails were bouncing back, 38 times we heard from protégés stating that their mentors' emails were bouncing back. During the year, we heard from protégés 13 times to get their mentors' email addresses, since they had misplaced the address or their computers crashed and they had lost their mentors' email addresses. We also heard from 9 mentors who notified us that they had changed their email addresses and asked us to update our records. In addition, we heard from participants when they had positive comments, suggestions, or questions. During the year, we also heard from mentors 13 times when they sent positive comments about their experience participating in MentorNet and 39 times when they had suggestions or questions for us. We heard from protégés 5 times with positive comments and 5 times with suggestions or questions.

In summary, after actively accepting the ementoring match, more protégés then ementors failed to follow through on their commitments by not responding to their ementors. Interestingly, the ementors more often had technology problems, which disrupted the correspondence between the ementoring partners. Protégés were more likely to have misplaced their ementors' email address and ementors were more likely to have updated their email address during the program year.

Discussion

From prior research on face-to-face mentoring programs, structured mentoring programs, which provide proactive matching and coaching during the program duration, have reported more compliance from the participants and have reported more beneficial outcomes. These beneficial outcomes are not without cost – increased efforts and resources are required to conduct a structured mentoring or ementoring program than when conducting a mentoring program where mentors and protégés are matched without additional coaching or contact from the program facilitator. While ementoring programs are in their infancy, this paper strives to quantify the effort required to conduct a *structured* ementoring program. In addition, this research identifies some of the reasons that hinder the successful completion of an ementoring relationship, and thereby try to interpret the reasons for and to overcome these hindrances.

Regarding the matching process, the number of mentors and students who did not accept the initial mentoring matches supports the use of this step as increasing the integrity of the mentoring pairs. Yet, the benefits from implementing this step must be weighed against the staff and resources needed to send the preliminary messages, receive responses, and update the databases to identify the pairs where both the prospective mentor and the prospective protégé accepted the match.

Regarding the 73 students and 55 mentors who did not reply to the match review email, we can only conclude that their ability (e.g., easy access to technology) or desire (e.g., too busy) to participate in the program changed from when they had submitted an application. Students are significantly more likely than mentor not to accept the mentoring opportunities. Having been the beneficiary of mentoring, these professionals may believe that good mentoring relationships can develop between persons who are not identically matched whereas the students may have a narrower tolerance for the person by whom they would like to be mentored.

After the ementoring pairs were launched, we learned by keeping in contact with the participants through the coaching process that students were more likely than mentors to cease to respond to their ementoring partner. Students are more likely to pull out of the mentoring relationships based on scheduling demands than are the mentors. Yet, mentoring relationships show the positive benefits to the protégés and that the time investment is amply rewarded.

Notably, when technology problems disrupted the interaction between ementoring partners, it was usually due to the mentors' email accounts having problems. It seemed that during the program year, employers and Internet Service Providers (ISPs) were more likely to be disrupt email access by updating email programs or having server problems than were universities and colleges. Meanwhile, many of these mentors continued to be interested in participation and were not aware of the difficulty their protégé was having while trying to maintain contact. Phone calls to the mentors often helped alleviate or explain the problem. This supports the needs to get an alternative method for contacting the participants, namely, collecting telephone numbers during the application process and perhaps providing telephone numbers to the ementoring partners so they can reconnect between themselves when technology problems arise.

In general, students are more particular about the requirements for a suitable ementoring partner. This leads us to conclude that the mentors may have a more open perspective of mentoring and students may have more rigid expectations. After having accepted the matches, again it was the students who require more attention, were more likely to cease to respond and were more likely to report that time constraints hindered their ability to participate in the ementoring program.

This study is an initial step in quantifying the effort required to make an ementoring program successful. The data support that intermediary steps between matching and launching mentoring pairs select out the applicants who enthusiastically sign up but are not able to comply with the program requirements. The data also show that protégés, the primary beneficiaries of the mentoring relationships, are more likely to deny themselves an opportunity, whereas the mentors are more likely to follow through on their commitment.

The implications of this study support the need for the programmatic supports provided in a structuring mentoring program. This study also suggests that more attention be paid to the expectations and follow-through of the protégés. Mentor training has become a commonplace activity among mentoring programs, perhaps protégé training is warranted to educate protégés about the expectations for them, the benefits of their participation, and the importance of following through on pre-professional commitments. Finally, this study supports that many aspects of a mentoring program can be examined and quantified. The mentoring process has received much attention; the mentoring *program* process has not. Perhaps we could develop even more successful and effective mentoring programs as we study and examine the mentoring program process, thereby increasing the benefits to those participating in the mentoring programs.

Table 1

MentorNet's Actual and Projected Growth Plan

GENERAL STATISTICS	Actual			Projected	
	Pilot Semester 1998	Year 1 1998-1999	Year 2 1999-2000	Year 3 2000-2001	Year 4 2001-2002
Students Matched	204	515	1,250	2,200	3,500
Mentors Matched	204	515	1,214	2,200	3,500
Participating Campuses	15	26	36	55	80
Companies Represented by Mentors	93	261	588	-	-

Table 2

Steps included in and results from the matching process.

Participants	Applications	Matching Process						
		Total Initial Matches	Review by MentorNet Staff		Review by Participants			Final Matches at Completion of Matching Phase
			Rejected	Accepted	Not accepted	No response	Total not accepted or no response	Accepted	
Students/ Protégés	973	809	73	736	69	73	142	594	550
Professionals/ Mentors	693	809	73	736	32	55	87	649	550

Table 3

Participant responses to coaching.

	Participant not responding	Bounced back emails	Request for partners' email address	Request to update own email address	Positive comments received	Suggestions or questions
Protégés	29	9	12	0	5	5
Mentors	8	38	5	9	13	39

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